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An Improved Comprehensive Model for the Apparent Viscosity of Blood FRANK JACOBITZ, SPENCER ANDERSON, University of San Diego — An improved comprehensive model for the apparent viscosity of blood is developed and used in simulations of the microcirculation in capillary bundles of rat spinotrapezius muscle fascia. In the microcirculation, the apparent viscosity of blood depends on the local vessel diameter, hematocrit, and shear rate. The proposed comprehensive model extends the apparent viscosity model developed by Pries, Secomb, Gaehtgens, and Gross (Circulation Research, 67, 826-834, 1990), which describes the effect of vessel diameter and hematocrit on the apparent viscosity. A shear thinning term is developed using the experimental data of Lipowsky, Usami, and Chien (Microvascular Research, 19, 297-319, 1980). Curve fits of this data can be combined with equations given in the Pries et al. work to create a system of equations that can be used to find the shear thinning factor. The simulations based on the improved apparent viscosity model use realistic vessel topology for the microvasculature, reconstructed from microscope images of tissue samples, and consider passive and active vessel properties. The numerical method is based on a Hagen-Poiseuille balance in the microvessels and a sparse matrix solver is used to obtain the solution. It was found that the inclusion of the shear factor decreases the overall flowrate in the capillary bundle. Many vessel connections in the fascia are characterized by relatively low shear rates and therefore increased apparent viscosity.

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